

WHAT IS CLAIMED IS:

1. A method of cleaning surfaces and surface cracks on a metallic article, comprising the steps of:

(a) disposing the article within a vacuum furnace;

(b) heating the article within the vacuum furnace;  
and

(c) repetitively cycling hydrogen gas and a vacuum within the furnace by supplying in each cycle a fresh supply of hydrogen gas within the furnace followed by removal of reaction products between hydrogen gas and surface contaminants and substantially all residual hydrogen gas from within the furnace.

2. A method according to Claim 1 including evacuating the furnace to a vacuum pressure of about 50 microns or less.

3. A method according to Claim 1 including evacuating the furnace to a vacuum pressure of about 1 micron or less.

4. A method according to Claim 1 including providing the hydrogen gas within the furnace at a pressure within a range of about 500-10000 microns.

5. A method according to Claim 1 including providing the hydrogen gas within the furnace at a pressure within a range of about 6000-9000 microns.

6. A method according to Claim 4 including evacuating the furnace to a vacuum pressure of about 50 microns or less.

7. A method according to Claim 4 including evacuating the furnace to a vacuum pressure of about 1 micron or less.

8. A method according to Claim 5 including evacuating the furnace to a vacuum pressure of about 50 microns or less.

9. A method according to Claim 5 including evacuating the furnace to a vacuum pressure of about 1 micron or less.

10. A method according to Claim 1 wherein step (b) includes heating the component within the furnace to a temperature of about 1400°F and wherein step (c) includes introducing the hydrogen gas in each cycle with the article maintained at a temperature of about 1400°F or above.

11. A method according to Claim 1 including, subsequent to step (c), (d) cooling the article under an inert gas.

12. A method according to Claim 11 including, subsequent to step (d), removing the cleaned article from the furnace and applying a filler of a molten metal to the surface cleaned by steps (a)-(d).

13. A method according to Claim 1 including maintaining the hydrogen gas in each cycle for a time period of between about ten minutes and four hours.

14. A method according to Claim 1 including maintaining the hydrogen gas in each cycle for a time period of between about thirty minutes and sixty minutes.

15. A method of refurbishing surfaces on a turbine component formed of a cobalt-based alloy wherein the surfaces include oxide contaminants, comprising the steps of:

- (a) disposing the turbine component within a vacuum furnace;
- (b) heating the turbine component within the vacuum furnace;
- (c) repetitively cycling hydrogen gas and a vacuum within the furnace by supplying in each cycle a fresh supply of hydrogen gas within the furnace, followed by removal of reaction products between the hydrogen gas and surface oxides and substantially all of any residual hydrogen gas from within the furnace; and
- (d) adhering a molten metal to the cleaned surface of the turbine component subsequent to step (c) to refurbish the surface.

16. A method according to Claim 15 including providing the hydrogen gas within the furnace at a

pressure within a range of about 6000-9000 microns and evacuating the furnace to a vacuum pressure of about 50 microns or less.

17. A method according to Claim 15 including providing the hydrogen gas within the furnace at a pressure within a range of about 6000-9000 microns and evacuating the furnace to a vacuum pressure of about 1 micron or less.

18. A method according to Claim 16 wherein the hydrogen gas pressure is maintained for a predetermined time and including heating the turbine component to a temperature of about 2200°F and maintaining the pressure of said temperature for said predetermined time.

19. A method of cleaning surfaces and surface cracks on a metallic article, comprising the steps of:

- (a) disposing the article in a vacuum furnace;
- (b) evacuating the furnace;
- (c) heating the component in the vacuum furnace;
- (d) in a first cycle, introducing hydrogen gas into the furnace to obtain a partial pressure within the furnace;
- (e) raising the temperature of the article within the furnace to a predetermined temperature during said first cycle;

- (f) holding the predetermined temperature of the article within the furnace for a predetermined time period during said first cycle;
- (g) evacuating the furnace during said first cycle;
- (h) in a second cycle following said first cycle, reintroducing hydrogen gas into the furnace to obtain a partial pressure within the furnace;
- (i) raising the temperature of the article within the furnace to a predetermined temperature during said second cycle;
- (j) holding the predetermined temperature of the article within the furnace for a predetermined time period during the second cycle; and
- (k) evacuating the furnace during the second cycle.

20. A method according to Claim 19 wherein steps (b) and (g) include evacuating the furnace to a vacuum level of about 1 micron or below.

21. A method according to Claim 19 wherein step (c) includes heating the article to about 1400°F.

22. A method according to Claim 21 wherein the hydrogen gas of step (d) is introduced into the furnace when the temperature of the article is about 1400°F.

23. A method according to Claim 19 wherein steps (e) and (i) include raising the temperature of the article within the furnace to about 1800°F or higher.

24. A method according to Claim 19 wherein steps (e) and (i) include raising the temperature of the article within the furnace to about 2200°F.

25. A method according to Claim 19 wherein steps (f) and (j) include holding the predetermined temperature of the article within the furnace for a period of between .5-1 hour.

26. A method according to Claim 19 including, subsequent to step (k), cooling the article within the furnace under an inert gas.

27. A method according to Claim 19 wherein steps (a) through (k) are performed in sequence and, following step (k) and in a third cycle, reintroducing partial pressure hydrogen gas into the furnace, raising the temperature of the article within the furnace to a predetermined temperature, holding the predetermined temperature of the article within the furnace for a predetermined time period and evacuating the furnace.

28. A method according to Claim 19 wherein steps (b) and (g) include evacuating the furnace to a vacuum level of about 1 micron or below, step (c) includes heating the article to about 1400°F, steps (e) and (i) include raising the temperature of the article within the furnace to about 2200°F and steps (f) and (j) include holding the predetermined temperature of the article within the furnace for a period of at least about .5-1 hour.